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Supporting Information for

Rising atmospheric CO_2 leads to large impact of biology on Southern Ocean CO_2 uptake via changes of the Revelle factor

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Additional Supporting Information (Files uploaded separately)

none

Introduction

This text describes the steps performed for the extended multiple linear regression (eMLR) example calculation.

Text S1.

(1) For the eMLR a multi linear regression (MLR) for the reference year 2011 is calculated according to the equation:

DIC(2011) = a1 + b1 * theta(2011) + c1 * alk(2011) + d1 * DIN(2011)

where dissolved inorganic carbon (DIC, mmol/m3), potential temperature (theta, °C) alkalinity (alk, mmol/m3) and dissolved inorganic nitrogen (DIN, equivalent to nitrate + ammonium, mmol/m3) is model output for the year 2011 and all 12 months are used for the MLR. The coefficients a1, b1, c1 and d1 are the outcome of the regression.

(2) Then a second multiple linear regression is calculated for all years between 2012 and 2100 with the same variables and considering all 12 months of the respective year:

DIC(year2) = a2 + b2 * theta(year2) + c2 * alk(year2) + d2 * DIN(year2)

(3) The accumulated anthropogenic carbon concentration for every year (i.e. year2=2012:2100) relative to the reference year 2011 is then calculated as

C_ant(year2) = (a2-a1) + (b2-b1) * theta(year2) + (c2-c1) * alk(year2) + (d2-d1) * DIN(year2)

and the unit of C_ant is mmol/m3.

(4) The inventory (mmol) of the 3D C_ant field is calculated as

C_ant_int = sum(sum(sum (C_ant * volume)))

For more details on the eMLR method see
Friis et al 2005, doi:10.1016/j.dsr.2004.11.017 and
Hauck et al., 2010, doi: 10.1029/2009JC005479